REMARKS

This communication is a full and timely response to the final Office Action dated April 8, 2005 (Paper No./Mail Date 20050331). By this communication, Applicant has amended claim 4.

Claim 4 has been amended to recite that when said calculated local energy is greater than a predetermined threshold value, said edge enhancement means performs a one-dimensional filtering process through a one-dimensional edge building filter such that the value of each pixel is multiplied by a corresponding coefficient of a plurality of coefficients and the products of each respective multiplication are added together, and wherein the one-dimensional edge building filter coefficients include a scaling factor. Support for the subject matter added to claim 4 can be found variously throughout the specification and claims, for example, in original claim 1. No new matter has been added.

Claims 1-14 are pending where claims 1, 11, and 12 are independent.

Rejection Under 35 U.S.C. §112

Claims 2 and 3 were rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. In particular, the Office Action alleges that the terms "loose connection" and "tight connection" as recited in claim 2 are not clearly defined in the specification. Applicant respectfully traverses this rejection.

In the previous response, Applicant inadvertently and without deceptive intent described the "loose connection" and "tight connection" characteristics of an image as if they were a type of image. This earlier description contradicted the language of claims that describes the "loose connection" and "tight connection" as portions of an image. Applicant respectfully retracts the earlier statement and in the discussion that follows, identifies a portion of the specification that defines the "loose connection" and "tight connection" in a manner that is consistent with the language of claim 2.

In paragraph [0065] of the '028 publication, the present invention discloses that an edge connector is used to increase the edge width of an image. The edge width of an image is increased when it is determined that the image has a thin edge or "loose connection." This "loose connection" makes it difficult to enlarge the image by interpolating in the edge direction. Pre-processing is performed on the image so that the edges of the image can be detected easily and precisely. In other words, the pre-processing operation converts the "loose connection" of

the image into a tight connection. Examples of images that include "loose connections" are computer icons or word processor fonts.

To comply with the written description requirement of 35 U.S.C. § 112, first paragraph, each claim limitation must be expressly, implicitly, or inherently supported in the originally filed disclosure. When an explicit limitation in a claim "is not present in the written description whose benefit is sought it must be shown that a person of ordinary skill would have understood, at the time the patent application was filed, that the description requires that limitation." *Hyatt v. Boone*, 146 F.3d 1348, 1353, 47 USPQ2d 1128, 1131 (Fed. Cir. 1998). An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1572, 41 USPQ2d 1961, 1966 (Fed. Cir. 1997). Possession may be shown in a variety of ways including description of an actual reduction to practice, or by showing that the invention was "ready for patenting" such as by the disclosure of drawings or structural chemical formulas that show that the invention was complete, or by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention. See, e.g., *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 68, 119 S.Ct. 304, 312, 48 USPQ2d 1641, 1647 (1998); *Regents of the University of California v. Eli Lilly*, 119 F.3d 1559, 1568, 43 USPQ2d 1398, 1406 (Fed. Cir. 1997); *Amgen, Inc. v. Chugai Pharmaceutical*, 927 F.2d 1200, 1206, 18 USPQ2d 1016, 1021 (Fed. Cir. 1991).

Based on at least the aforementioned portion of the specification and relevant case law, Applicant respectfully submits that the claimed terms "loose connection" and "tight connection" are sufficiently supported in the specification. In particular, based on the disclosure it should be readily apparent to one of ordinary skill in the art that an image has a "loose connection" when the edges of the image are thin, and a "tight connection" when the edges of an image have a width that makes the edges easily and precisely detected. Accordingly, Applicant respectfully requests that the rejection of claims 2 and 3 under 35 U.S.C. §112, first paragraph be withdrawn.

Claims 2 and 3 were rejected under 35 U.S.C. §112, second paragraph as indefinite. In particular, the Office Action alleges that (1) the specification provides an example of a "loose connection" and a "tight connection," but fails to provide a clear definition of either term; and

(2) it is not clear how the edge connecting process can be performed prior to the calculation of local energy. Applicant respectfully traverses this rejection.

In response to the first allegation, Applicant respectfully submits that the specification sufficiently defines the recited "loose connection" and "tight connection." As discussed above, paragraph [0065] of corresponding U.S. Patent Application Publication No. 2002-0028028 describes a "loose connection" as a thin edge of an image. This "loose connection" can be pre-processed to convert the thin edge into an edge that has a width that can be easily and precisely detected. In other words, the pre-processing method converts the "loose connection" into a "tight connection." At paragraph [0174], for example, the specification provides further support for the definition of the "loose connection" and "tight connection" discussed at paragraph [0065].

In reviewing a claim for compliance with 35 U.S.C. 112, second paragraph, the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph, by providing clear warning to others as to what constitutes infringement of the patent. See, e.g., *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000). The test for definiteness under 35 U.S.C. 112, second paragraph, is whether "those skilled in the art would understand what is claimed when the claim is read in light of the specification." *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986). Because the terms "loose connection" and "tight connection" are adequately defined in the specification, Applicant respectfully submits that metes and bounds of the claim provide clear warning to others as to what constitutes infringement of the patent.

In response to the second allegation, Applicant respectfully submits that the specification clearly discloses the manner in which the edge connecting process is performed before the calculation of local energy. As discussed at paragraph [0166] of the 028 publication, a right diagonal and left diagonal are calculated. Specifically, the right diagonal energy is calculated by subtracting the pixel value of a lower left pixel of the 2x2 pixels from the pixel value of an upper right pixel, and the left diagonal energy is calculated by subtracting the pixel value of a lower right pixel from the pixel value of an upper left pixel. However, during the calculation of local energy for each pair of pixels lying on a diagonal line, the pixel value of a pixel in a lower row is subtracted from the pixel value of a pixel in an upper row. The pixel value differences are

calculated for the respective diagonal lines, and the sum of absolute values of the differences is employed as the local energy E(N). The local energy E(N) is defined as

$$E(N) = \sum_{I=0 \cdot N-1} ABS(up\_line(I) - down\_line(N - I - 1)),$$

in which the pixel values of the respective pixels in the upper row (up_line) are reduced by amounts of the pixel values of the corresponding pixels at the diagonal locations in the lower row (down_line), and the sum of the absolute values of those differences is determined. Specifically, the local energy is a summation of absolute values of the left and right diagonal energy between two rows of pixels. Based on at least this discussion provided in the specification, Applicant respectfully submits that the calculation of the left and right diagonal energies in the edge connection process is different from the local energy calculation performed during the edge building process. Accordingly, the edge connection process can be performed prior to the calculation of local energy.

In summary, Applicant respectfully submits that the specification clearly defines the terms "loose connection" and "tight connection" and clearly discloses how the edge connecting process is performed before the calculation of local energy. Accordingly, Applicant respectfully requests that the rejection of claims 2 and 3 under 35 U.S.C. §112, second paragraph be withdrawn.

Rejections Under 35 U.S.C. §102

Claims 1, 5-7, 11, and 12 were rejected under 35 U.S.C. §102(e) as anticipated by *Aoyama et al.*, U.S. Patent No. 6,535,651. Applicant respectfully traverses this rejection.

Claim 1 recites an image processing apparatus for converting the resolution of an original image in such a manner as to increase the spatial resolution of said original image by a factor of Z in each of vertical and horizontal directions, said image processing apparatus comprising energy calculating means for calculating local energy of said original image based on two rows of pixels in said original image; detection means for detecting the direction of an edge based on said local energy calculated by said energy calculating means; interpolation means for interpolating a new pixel from a pixel of said original image based on the direction of the edge detected by said detection means; and edge enhancement means for performing an edge enhancement process based on said local energy calculated by said energy calculating means.

Claim 11 recites an image processing method of converting the resolution of an original image in such a manner as to increase the spatial resolution of said original image by a factor of

Z in each of vertical and horizontal directions, said image processing method comprising the steps of calculating local energy of said original image based on two rows of pixels in said original image; detecting the direction of an edge based on said local energy calculated in said energy calculating step; interpolating a new pixel from a pixel of said original image based on the direction of the edge detected in said detection step; and performing an edge enhancement process based on said local energy calculated in said energy calculating step.

Claim 12 recites a storage medium storing a computer-readable program for controlling an image processing apparatus to convert the resolution of an original image in such a manner as to increase the spatial resolution of said original image by a factor of Z in each of vertical and horizontal directions, said program comprising the steps of calculating local energy of said original image based on two rows of pixels in said original image; detecting the direction of an edge based on said local energy calculated in said energy calculating step; interpolating a new pixel from a pixel of said original image based on the direction of the edge detected in said detection step; and performing an edge enhancement process based on said local energy calculated in said energy calculating step.

In summary, independent claims 1, 11, and 12 recite an apparatus, method, and program, respectively, that convert the resolution of an original image in such a manner as to increase the spatial resolution of said original image by a factor of Z in each of vertical and horizontal directions by, among other things, calculating local energy of said original image based on two rows of pixels in said original image. In performing this calculation, the pixel values of the respective pixels in the upper row are reduced by amounts of the pixel values of the corresponding pixels at the diagonal locations in the lower row, and the sum of the absolute values of those differences is determined. Using two rows of pixels in the original image provides an easier way for calculating local energy. In addition, using two rows of pixels enables processing that enlarges an edge in the vertical direction or horizontal direction.

Aoyama discloses an interpolating method and apparatus for processing image signals. The interpolating apparatus has an edge presence or absence judging means 31, a first interpolation operating means 40, and a second interpolating operating means 50. The edge presence or absence judging means 31 determines whether the interpolation point belongs to an edge portion or a flat portion. The first interpolating operation means 40 specifies the direction along which the image edge portion extends, and divides a unit lattice of the image into triangular regions with image edge serving as the boundary between the regions. The second

interpolating operating means 50 inputs an instruction that alters the sharpness of a flat portion of the image along the exterior of the image. The interpolating method further calculates two an image density gradient vectors I and J. The difference between I and J is compared with a predetermined threshold value so that the direction along which the image portion of the image extends can be specified.

The final Office Action alleges that at col. 38, lines 7-8, *Aoyama* discloses calculating a local energy of an original image based on two rows of pixels. However, at this portion of the disclosure *Aoyama* merely discusses that an image density gradient may be calculated from the sum of the original image signal components. As discussed above, the image signal components correspond to individual lattice points of the image. Thus, the calculation of the image density gradient of *Aoyama* is not analogous to the local energy calculation as recited in the claims.

The final Office Action further alleges that Applicant's previous arguments concerning edge enhancement fail to comply with 37 CFR §1.111(b). However, in the previous response Applicant clearly detailed the reasons why *Aoyama* failed to disclose, teach, or suggest the calculation of local energy as recited in the claims. Based on these reasons, Applicant concluded that based on the lack of the local energy calculation no edge enhancement was not performed. Though Applicant did not use this exact wording, the introduction of the last sentence using the phrase "in other words," generally infers that the previous sentence or idea has an alternate meaning. For at least these reasons, Applicant's previous arguments fully comply with the provisions of 37 CFR §1.111.

To properly anticipate a claim, the document must disclose, explicitly or implicitly, each and every feature recited in the claim. *See* Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). *Aoyama* fails to disclose, teach, or suggest every element recited in independent claims 1, 11, and 12, therefore these claims are not anticipated by *Aoyama*. Accordingly, Applicant respectfully requests that the rejection of claims 1, 11, and 12 under 35 U.S.C. §102 be withdrawn, and these claims be allowed.

Claims 5-7 depend from claim 1. By virtue of this dependency, Applicant submits that claims 5-7 are allowable for at least the same reasons given above with respect to claim 1. In addition, Applicant submits that claims 5-7 are further distinguished over *Aoyama* by the additional elements recited therein, and particularly with respect to each claimed combination. Applicant respectfully requests, therefore, that the rejection of claims 5-7 under 35 U.S.C. §102 be withdrawn, and these claims be allowed.

Rejections Under 35 U.S.C. §103

Claims 2 and 3 were rejected under 35 U.S.C. §103(a) as unpatentable over *Aoyama* and further in view of *Klassen*, U.S. Patent No. 6,741,751. Applicant respectfully traverses this rejection.

Claims 2 and 3 depend from claim 1. By virtue of this dependency, Applicant submits that claims 2 and 3 are allowable for at least the same reasons given above with respect to claim 1. In addition, Applicant submits that claims 2 and 3 are further distinguished over *Aoyama* and *Klassen* by the additional elements recited therein, and particularly with respect to each claimed combination. Applicant respectfully requests, therefore, that the rejection of claims 2 and 3 under 35 U.S.C. §103 be withdrawn, and these claims be allowed.

Claims 4 and 14 were rejected under 35 U.S.C. §103 as unpatentable over *Aoyama* and further in view of *Moronaga et al.*, U.S. Patent No. 5,229,864. Applicant respectfully traverses this rejection.

Claim 4 depends from claim 1 and additionally recites when said calculated local energy is greater than a predetermined threshold value, said edge enhancement means performs a one-dimensional filtering process through a one-dimensional edge building filter such that the value of each pixel is multiplied by a corresponding coefficient of a plurality of coefficients and the products of each respective multiplication are added together, and wherein the one-dimensional edge building filter coefficients include a scaling factor. The Office Action acknowledges that *Aoyama* fails to disclose, teach, or suggest at least the elements of claim 4 and relies on *Moronaga* to remedy this deficiency.

Moronaga discloses that a one-dimensional filter, wherein the respective products of each multiplication are summed. Moreover, *Moronaga* discloses that the one dimensional filtering process is performed based on the amount of coded data Bxy. *Moronaga*, however, fails to disclose, teach, or suggest at least when said local energy is greater than a predetermined threshold value, said edge enhancement means performs a one-dimensional filtering process. In contrast, *Moronaga* discloses that the amount of coded data Bxy corresponds to the many high frequency components and coded data within the individual blocks of an 8x8 matrix. Applicant submits that the amount of coded data as disclosed by *Moronaga* is not analogous to the local energy of a pixel. Basing the one-dimensional filter process on the local energy, as recited in

claim 4, has the advantage of enabling the filtering process to be adapted for the surrounding pixels.

The final Office Action alleges that the high frequency components of an 8x8 matrix of pixels in *Moronaga* qualify as the local energy recited in claim 4. However, this alleged local energy of *Moronaga* is not calculated. In particular, the high frequency components disclosed in *Moronaga* are components of the original signal and are more analogous to the lattice points disclosed in *Aoyama*, which too are components of the original signal.

In summary, *Aoyama* and *Moronaga* either singly or combined fail to disclose teach or suggest at least when said **calculated local energy** is greater than a predetermined threshold value, said edge enhancement means performs a one-dimensional filtering process. At best, the combined references teach performing a one-dimensional filtering process when the amount of data within the individual blocks of an 8x8 matrix is greater than a predetermined threshold TH3. The disclosed amount of data of the references are components of the original image or signal and are not analogous to the **calculated local energy** as recited in the claim. Accordingly, a *prima facie* case for obviousness has not been established.

To establish *prima facie* obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Moreover, obviousness "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." ACS Hosp. Sys. V. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). For at least the above reasons, Applicant respectfully requests that the rejection of claim 4 be withdrawn, and claim 4 be allowed.

Claim 14 depends from claim 4. By virtue of this dependency, Applicant submits that claim 14 is allowable for at least the same reasons given above with respect to claim 1. In addition, Applicant submits that claim 14 is further distinguished over *Aoyama* and *Moronaga* by the additional elements recited therein, and particularly with respect to the claimed combination. Applicant respectfully requests, therefore, that the rejection of claim 14 under 35 U.S.C. §103 be withdrawn, and this claim be allowed.

Claim 8 was rejected under 35 U.S.C. §103(a) as unpatentable over *Aoyama* and further in view of *Sato*, U.S. Patent No. 4,985,764. Applicant respectfully traverses this rejection.

Claim 8 depends from claim 1 and additionally recites said consistency judging means determines that a value obtained by multiplying a first difference and a second difference is negative, wherein the first difference is obtained by subtracting the new pixel value from the pixel value of a pixel located at the center of the upper row, and wherein the second difference is obtained by subtracting the pixel value of a pixel located at the center of the lower row from the new pixel value.

The Office Action acknowledges that *Aoyama* fails to disclose, teach, or suggest the elements recited in claim 8, and relies on *Sato* to remedy this deficiency.

Sato discloses an apparatus for detecting a pixel correlation and generating an interpolation signal for a digital television signal. In one embodiment, *Sato* discloses a process of preventing the degradation of picture quality through a minimum value detection section 6a, 6b, 6c, 6d, and 6e of correlation detection section 200. In these minimum value detection sections output signals from absolute value circuits are subtracted from each other to produce positive or negative polarity data. *Sato*, however, fails to disclose, teach, or suggest at least multiplying a first difference and a second difference is negative, wherein the first difference is obtained by subtracting the new pixel value from the pixel value of a pixel located at the center of the upper row, and wherein the second difference is obtained by subtracting the pixel value of a pixel located at the center of the lower row from the new pixel value. Namely, *Sato* fails to disclose, teach, or suggest a multiplication operation as recited in claim 8. Applicant requests that if *Sato* does in fact teach a multiplication operation as alleged in the final Office Action, the drawing element and corresponding portion of the specification that discusses the use of this multiplication operation be identified. Thus, even if *Aoyama* discloses a consistency determination as alleged in the final Office Action, which Applicant submits it does not, *Sato* still fails to remedy the acknowledged deficiencies. For at least the above reasons, *Aoyama* and *Sato* either singly or combined fail to teach every element recited in claim 8, a *prima facie* case for obviousness has not been established.

To establish *prima facie* obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Moreover, obviousness "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." ACS Hosp. Sys. V. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933

(Fed. Cir. 1984). For at least the above reasons, Applicant respectfully requests that the rejection of claim 8 be withdrawn, and claim 8 be allowed.

Claims 9 and 13 were rejected under 35 U.S.C. §103(a) as unpatentable over *Aoyama* and in view of *Ng et al.*, U.S. Patent No. 5,450,531 and further in view of *Russ*, The Image Processing Handbook, 1995. Applicant respectfully traverses this rejection.

Claims 9 and 13 depend from claim 1. By virtue of this dependency, Applicant submits that claims 9 and 13 are allowable for at least the same reasons given above with respect to claim 1. In addition, Applicant submits that claims 9 and 13 are further distinguished over *Aoyama*, *Ng*, and *Russ* by the additional elements recited therein, and particularly with respect to each claimed combination. Applicant respectfully requests, therefore, that the rejection of claims 9 and 13 under 35 U.S.C. §103 be withdrawn, and these claims be allowed.

Conclusion

Based on at least the foregoing amendments and remarks, Applicants submit that claims 1-14 are allowable, and this application is in condition for allowance. Accordingly, Applicants request favorable reexamination and reconsideration of the application. In the event the Examiner has any comments or suggestions for placing the application in even better form, Applicants request that the Examiner contact the undersigned attorney at the number listed below.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 18-0013, under Order No. SON-2199 from which the undersigned is authorized to draw.

Dated: May 12, 2005

Respectfully submitted,

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